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Coherent Time-Dependent Variation of 87Sr/86Sr in Clinopyroxene From the Alban Hills Volcanic District (Central Italy): Clues to Source Evolution

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It is unclear whether the Alban Hills volcano near Rome is extinct or whether it is inactive. To address this question we have been studying the chemical evolution of its eruptive products, where unaltered materials are found only as inclusions in phenocrysts. We measured the 87Sr/86Sr of Sr in clinopyroxene phenocrysts from a complete suite of volcanic products (pyroclastic flows, lava flows, and granular ejecta) of the ultra-potassic Alban Hills Volcanic District, encompassing its entire eruptive history for the time span 608 – 35 ka. Each analyzed sample was dated by means of 40Ar/39Ar geochronology, in order to investigate the evolution of the magmatic system. The 87Sr/86Sr of the pyroxenes ranges from 0.7112 to 0.7085, and a correlation between eruption age and 87Sr/86Sr is apparent. In particular, 87Sr/86Sr shows a near-linear, time-dependent decrease from the oldest to youngest samples. An exception to this occurs at 70 ka, the age of the start of the latest eruptive cycle in the Albano Maar, whose pyroxenes have 87Sr/86Sr below this long-term trend. Based on the long duration of the eruptive history and the large volume of erupted products, we interpret the general trend as representative of variation in the magma source, rather than assimilation during storage in crustal magma chambers. Partial melting of metasomatically-veined and fertilized mantle has been proposed to explain the origin of these ultra-potassic magmas. If correct, the decreasing 87Sr/86Sr with time could reflect the progressive exhaustion of the metasomatic components (i.e. veins) in the mantle source region. In contrast, in the light of independent petrologic and geochronologic data, we hypothesize that the 70 ka anomaly may be linked to a renewal of the magma source.